Research Paper | Medical Science | E-ISSN No : 2454-9916 | Volume : 2 | Issue : 10 | Oct 2016

EPIDEMIOLOGICAL PROFILE OF 2010-2015 DENGUE IN SAO PAULO

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Introduction

History

Dengue is an ancient disease, being recognized in Asian medical texts of antiquity. According to a historical survey of the Pan American Health Organization, Dengue could have manifested itself for the first time, in the Americas in 1635. Since the first outbreaks, were described almost simultaneously in Asia, Africa and America between 1779 and 178¹.

However, Benjamin Rush only made the first official case report in 1789 during an epidemic in Philadelphia, in which he introduced the term "break bone fever".[(1,2)]

The first reference to Dengue in Brazil was in year 1846, when cases were reported in Curitiba (PR). In 1955, Brazil eradicated Aedes aegypti, seeking however, to fight against yellow fever, also transmitted by this mosquito. Thus, Dengue outbreaks are not observed in the country until the 80s decade. The reintroduction of the vector is assigned to the abandonment of control measures, to believe that the mosquito was definitely eradicated.[3,4]

In 1981, during an outbreak in Boa Vista (RR) there were isolated serotypes DEN -1 and DEN -4, the first virus subtypes found in Brazil until then. Soon after, in 1990-1991, it was found DEN- 2 serotype, and last being detected, serotype DEN- 3 was in 2001-2002.[4]

At the time, the four serotypes are found in almost all states of the country, contributing to the incidence of severe forms of the disease. Characterizing therefore, Dengue as a national public health problem.[4]

Pathogenesis:

Dengue fever is an acute febrile disease, whose etiologic agent is an RNA virus of the genus falvivírus, and has four different serotypes known. It is an arbovirus (a virus transmitted by arthropod) that occurs mainly in tropical countries, where there is presence of Aedes aegypti, the principal mosquito vector of the disease.[5]

The Dengue transmission occurs through the bite of an Aedes aegypti infected female. The virus incubation period is 5 to 6 days, on average, when appears the first manifestations of the disease.[5]

The main symptoms of a classic Dengue are fever, nausea, vomiting, rash, myalgia, arthralgia, headache, retro-orbital pain, petechial, and leukopenia. Signs such as, intense and continuous abdominal pain, persistent vomiting, respiratory distress, painful hepatomegaly, mucosal bleeding or major bleeding, and sudden drop of platelets, indicate a situation of Hemorrhagic Dengue fever.

In case of extreme complication, there is also the hypovolemic shock, leading to death.[5,6]

The mosquito life cycle takes place in four stages: egg, larva, pupa and adult. The female is the one that is actually infected with the virus, by putting the eggs there is the possibility of the larvae are born already contaminated. They develop in still waters, clean or dirty, and within 10 days they become adults, period in which they can acquire, and transmit the virus.[7,8]

Dengue control is a major challenge, because the Aedes aegypti is adapted to the urban environment, so to know their biology, it is also fundamental to study the insect's relationship with humankind, and the variables in which the species are inserted.[9]

The adaptation of Aedes aegypti to the urban environment makes the conditions provided by the cities, determinant in their proliferation.

The accumulated water is a decisive factor for the onset of the disease, since it is the environment of the reproduction of the mosquito. Therefore, to understand the dynamics between the quality and quantity of the water and, the proliferation of the transmitting agent, with consequent outbreak of epidemics, it is essential for proper operation under its control and prevention.

Objective

This study aims to verify the predisposing factors for Dengue epidemics in São Paulo, **and its relation** to the quantity and quality of water, as it is perceived an inconsistency between the lack of rain, therefore a small amount of water available for the mosquito to reproduce, and the epidemic in 2015.

Method

A longitudinal population study was done, over the years 2010-2015, on the epidemiological profile of Dengue in São Paulo.

Data were collected from information systems dispensing approval of the Research Ethics Committee.

They consulted the Emergency Management Center (CGE), organ of the São Paulo City Hall, responsible for monitoring the weather [(10)], and Surveillance Coordination Health (COVISA), local administrative organ of São Paulo, responsible for investigating cases, outbreaks and epidemics of notifiable diseases or unusual aggravations in the health area, and to monitor the epidemiology of these diseases situations[(11)].

The data collected refer to the current Dengue epidemic situation, and the history of rainfall in São Paulo, between 2010 and 2015.

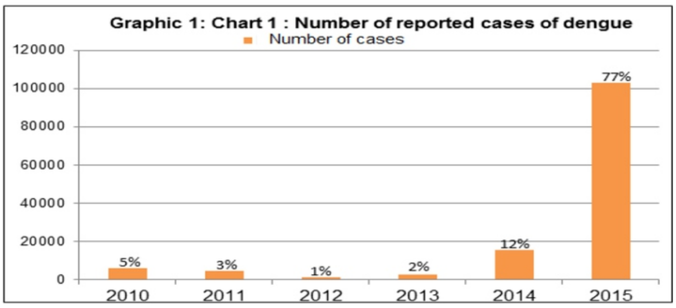
They compared the rainfall, and the frequency of native and foreign cases of this municipality.

Submitted to the data collected for statistical analysis of Friedman variant: in order to compare the years studied in each of the regions of the municipality; Kruskal- Wallis analysis of variance: in order to compare regions of each year; Spearman correlation coefficient: applied between the number of cases and rainfall in each year of study.[(12)]

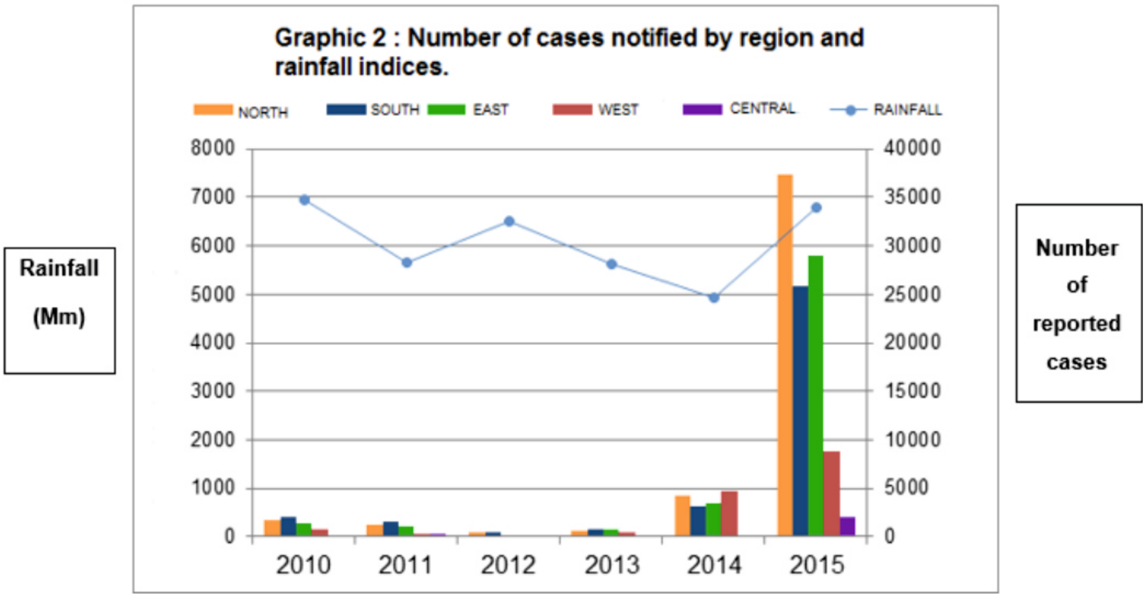
Was set at 0.05 or 5% the level of insignificance.

Results

Were analyzed not only the amounts of rain, as the number of Dengue cases in each region of São Paulo, according to the regional division of CGE (North Zone, East Zone, Central, South Zone, and West Zone) in the years 2010-2015.



(Graphic 1: Representing the reported cases of dengue annually and the proportion between the total numbers of cases each year in the city of São Paulo).



(Graphic 2: Number of cases separated by region and rainfall during the study period. Considering North Region: Anhanguera, Brasilândia, Casa Verde, Campo Grande, Cachoeirinha, Freguesia do Ó, Cidade Ademar, Jaçanã, Jaraguá, Limão, Mandaqui, Perus, Pirituba, Santana, São Domingos, Tremembé, Tucuruvi, Vila Maria, Vila Medeiros, Vila Guilherme; East Region: Água Rasa, Artur Alvim, Aricanduva, Belenzinho, Cangaíba, Carrão, Cidade Líder, Cidade Tiradentes, Ermelino Matarazzo, Guaianazes, Iguatemi, Itaim Paulista, Itaquera, Jardim Helena, José Bonifácio, Lajeado, Mooca, Ponte Rasa, Parque do Carmo, Penha, São Lucas, São Mateus, São Miguel Paulista, São Rafael, Sapopemba, Tatuapé, Vila Curuçá, Vila Formosa, Vila Jacuí, Vila Matilde, Vila Prudente; South Region: Campo Belo, Campo Grande, Campo Limpo, Capão Redondo, Cidade Ademar, Cidade Dutra, Cursino, Grajaú, Itaim Bibi, Ipiranga, Jabaquara, Jardim Angela, Jardim São Luis, Morumbi, Parelheiros, Pedreira, Sacomã, Santo Amaro, Saúde, Socorro, Vila Andrade, Vila Mariana; West Region: Alto de Pinheiros, Barra funda, Butatã, Jaguará, Jaguaré, Jardim Paulista, Lapa, Perdizes, Pinheiros, Raposo Tavares, Rio Pequeno, Vila Leopoldina, Vila Sonia Central Region: Bela Vista, Bom Retiro, Brás, Cambuci, Sé, Consolação, Liberdade, República, Pari, Santa Cecília).

When performing the descriptive statistical analysis of the data was obtained:

CHART 1: DESCRIPTIVE STATISTICS						
YEAR	**NORTH**	**SOUTH**	**EAST**	**WEST**	**CENTRAL**	**ANALYSIS RESULT**
2010	Mi = 81,5	Mi = 43	Mi = 37	Mi = 37	Mi = 10	Hcalculated = 19,51 (P=0,0006)
	X = 82,4	X = 86,2	X = 46,6	X = 60,5	X = 16,4	North, South , East and West > Central
2011	Mi = 40,5	Mi = 38	Mi = 21	Mi = 15	Mi = 18,5	Hcalculated = 8,22 (P=0,084)
	X = 59,3	X = 66,1	X = 34	X = 28,3	X = 25,2	
2012	Mi = 8,5	Mi = 7	Mi = 4	Mi = 2	Mi = 0	Hcalculated = 21,06 (P=0,0003)
	X = 23,4	X = 18	X = 5,2	X = 5,8	X = 2,3	North, South , East and West > Central
2013	Mi = 22	Mi = 18,4	Mi = 18	Mi = 14	Mi = 1	Hcalculated = 29,25 (P<0,0001)
	X = 30,1	X = 35,7	X = 25,6	X = 31,7	X = 1,7	North, South , East and West > Central
2014	Mi=145	Mi = 64	Mi = 59	Mi = 147	Mi = 8,5	Hcalculated = 32,67 (P<0,0001)
	X= 213	X=139,6	X=113,2	X = 362	X = 10,6	North, South , East and West > Central
2015	Mi=1171,5	Mi = 511	Mi = 823	Mi = 399	Mi = 226	Hcalculated = 27,47 (P< 0,0001)
	X = 1865	X=1173,6	X = 934,7	X = 680,4	X = 206,8	North, South , East and West > Central

Concluding that the number of cases in the north, south, east and west region were always higher than those of the central were every year, with P < 0.0001 in most years, and is therefore significant.

Held Friedman analysis of variance to compare the years studied in each region, were obtained:

CHART 2: FRIEDMAN ANALYSIS OF VARIANCE							
REGION/YEARS	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**ANALYSIS RESULT**
NORTH	Mi=81,5	Mi=40,5	Mi=8,5	Mi=22,0	Mi=145,5	Mi=1171,5	X^2= 37,53 (P<0,0001)
	X=82,4	X=59,4	X=23,4	X=30,1	X= 213	X=1865	2012< outros / 2015 > outros
SOUTH	Mi=43,0	Mi=38,0	Mi=7,0	Mi=18,0	Mi=64	Mi=511	X^2= 37,68 (P<0,0001)
	X=86,2	X=66,1	X=18,1	X=35,7	X=1339,6	X=1173,63	2012< outros / 2015 > outros
EAST	Mi=37,0	Mi=21,0	Mi=4,0	Mi=18,0	Mi=59	Mi=823	X^2= 61,91 (P<0,0001)
	X=46,6	X=34,0	X=5,3	X=25,6	X=113,2	X=934,7	2012< outros / 2015 > outros
WESTE	Mi=37,0	Mi=15,0	Mi=2,0	Mi=14,0	Mi=147	Mi=399	X^2= 25,50 (P<0,0001)
	X=60,5	X=28,3	X=5,8	X=31,8	X=362	X=680,4	2012< outros / 2015 > outros
CENTRAL	Mi=10,0	Mi=18,5	Mi=0,0	Mi=1,0	Mi=8,5	Mi=226	X^2= 22,05 (P<0,0001)
	X=16,4	X=25,2	X=2,3	X=1,7	X=10,6	X=206,8	2012< outros / 2015 > outros

Discussion

The initial goal of this study was to relate the amount of rainfall, and the number of Dengue cases. The motivation was the coincidence of historic drought in the State of São Paulo, and the Dengue epidemic that has taken place in this Region. The mosquito Aedes aegypti needs water to reproduce, it was soon expected that with a lower amount of water available, there would be a reduction in the number of Dengue cases, but the opposite occurred.

By comparing the data from the last five years, it is seen that the amount of rain had little influence on the numbers of Dengue cases. Spearman correlation test [12] showed that only 2 % of dengue cases were related to the amount of rainfall, and therefore insignificant.

The Central Region proved to be different from other regions (Chart 1) in following aspect: the number of cases reported each year was significantly lower, than that from other regions. The fact can be justified by the Central Region for being a predominantly commercial area with few houses, which means that there is a larger number of inhabitants during business hours. Therefore, incompatible with the times of highest activity A. aegypti [8] (early morning hours, end of the day, and during the night), which would explain the relatively small infection rates.

In Graphic 1, we can distinguish two different moments of the epidemiological behavior of Dengue. The first moment from 2010 until 2013, when it was noted a drop in the number of reported cases; while in 2012, the lowest rates were achieved (representing only 1% of all cases of the study period). It was also distinguished another time, from 2014 to 2015, when it was noticed a gradual and significant increase in reported cases in these regions, and in the year of 2015 reached 103.006 cases (corresponding to 77% of reported cases), an increase of 557.63% compared to 2014, when 15.663 cases were registered (about 12% of the total period).

In addition, by the year 2014, according to data from COVISA among cases reported, only approximately 5% were from abroad, showing that most were acquired in the city of São Paulo.

The reasons behind this drastic change in the profile of the disease are many, and sometimes uncertain, since the sum of several factors may have determined the phenomenon.

2010-2013:

The decreasing profile in the number of reported cases can be attributed to this period a series of measures and interdisciplinary strategies, which have been implemented throughout the country, by the Ministry of Health, and involved the health network, environmental, biological, and demographic studies, demonstrated to be effective in combating the disease. Applying measures, such as:

- Increased health education about the disease;
- Campaigns focused on environmental sanitation;

Investments approached to R$ 173, 2 million, and were distributed to the municipalities to control the vector. Guided by Dengue´s Risk, a tool for assessing the risks of epidemics in the cities, which made used of five basic criteria, and inter sectors: three in the health sector (incidence of cases in previous years, rate of infestation by the mosquito, and the dengue virus serotypes circulation), an Environmental (water supply coverage and garbage collection) and Demographic (population density), the resources could be divided correctly and effectively, which guaranteed better results;

- The increase in the effective of the agent's health that ensured greater coverage of households;
- The dissemination of information related to dengue in the media in various communication channels were decisive for the lower incidence of dengue in the period.[12]

2014-2015:

We can attribute the number of dengue cases in this period, possibly to the following facts:

To the natural adaptation of A. Aegypti in the urban environment, the various quality conditions, and the type of breeding grounds that big cities offer. It is believed that the A. aegypti, develops only in still and clean waters, but studies show that the mosquito has become able to develop in breeding's with high levels of pollution and greater turbidity, that is, less light penetrability in the aquatic environment. However, still not developing in raw sewage.[8,13]

Another important fact is that in addition to developing in polluted water, such water is also more attractive to A. Aegypti females put the eggs, and allow a complete development in a shorter period of time. [8]

It is also relevant to discuss the type of breeding that A. Aegypti found: the so-called small breeding, that is, small amounts of water accumulated deliberately or not, are responsible for maintaining entire populations of mosquitoes in cities, giving Dengue its endemic feature.

These breeding are easily found by the mosquito, because of its quantity and its variety, any container that allows a relatively small accumulation of water is a potential breeding. The household breeding, as water tanks, and those at ground level (accumulated garbage, tires, rubble, etc.), are pointed out as responsible for about a third of infections. [14]

It must also be considered the possibility of inadequate water deposits as a subject to become polluted, favoring, as seen previously, attracting females and egg lying exacerbating infection rates.

These facts become relevant when considering the amount of polluted streams, derelict lands, illegal landfills existent, and lack of awareness of the population of the City of São Paulo, when it comes to combating these potential breeding sites.

The year 2015 was the season of lowest rainfall since 1969[16] with cities subjected to shortage of water for long periods, which forced the population to store it. However, not always the storage is done properly, that is, tightly sealed to prevent the entry vector.

Studies conducted in other States, also injured of Dengue epidemics showed that when the water supply is not regular, causing the population to stock such resource, the number of Dengue cases tend to increase, as this improper storage leads to formation of new breeding and spreading the disease.[15,18]

Furthermore, in this period Brazil went through one of the biggest crises in its economy. With this recession, there was a reduction in health investments. The Federal Government disbursed in the year of 2015, 9.2% less resources than in the previous year to combat epidemics (dengue, malaria, tuberculosis, hepatitis and AIDS - there are no separate funds for each of them).Only in the State of São Paulo, investments in epidemiological monitoring dropped 7%, which contributed to the significant increase of cases, in the year of 2015.[19]

Conclusion

In periods of big investments in public policies, and implementation of effective measures to combat the disease, infection rates have decreased.

However, data showed that there was no continuity in these actions, which until then, had positive effects. This discontinuity, plus the natural adaptation of the mosquito vector to the urban environment and the different water qualities (including polluted water), reduction of investments and actions in health education and epidemiological surveillance, were crucial to the large increase in the number of cases in 2014 and 2015.

The rain itself was not a significant factor for dengue behavior during the study period. However, inadequate storage of water made by the population in 2015 (driven by the irregularity in water supply generated by the historic drought), may have been one of the main triggers for the Dengue epidemic of 2015.

Therefore, it can be said that the incidence of dengue cases is related more to economic, political and social factors than environmental.

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